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May 22, 2019

VIA ECFS

Marlene H. Dortch, Secretary
Federal Communications Commission
445 12th Street SW
Washington, DC 20554

Re: Notice of *Ex Parte* Presentation
TerreStar Corporation Request for Temporary Waiver of Substantial Service Requirements for 1.4 GHz Licenses, WT Docket No. 16-290

Dear Ms. Dortch:

On May 20, 2019, on behalf of TerreStar Corporation ("TerreStar"), Doug Brandon and John Dooley of TerreStar, Helgi Walker of Gibson, Dunn & Crutcher LLP, and Mark Settle and the undersigned of Wilkinson Barker Knauer LLP, met with Julius Knapp, Ira Keltz, Tom Mooring, Jamison Prime, and Aspa Paroutsas of the Commission's Office of Engineering and Technology ("OET"). During the meeting, we reiterated points made in TerreStar's unopposed Petition for Reconsideration, as well as in subsequent filings,[1] in support of the pending Petition for Reconsideration before the Wireless Telecommunications Bureau's regarding its prior denial of an extension of the substantial service deadlines for TerreStar's 1.4 GHz spectrum licenses.

Specifically, we explained that TerreStar was unable to meet the substantial service deadlines associated with its 1.4 GHz licenses through no fault of its own. In 2013, after reaching out to the wireless medical telemetry community at the suggestion of OET, TerreStar discovered that its plans to build a smart grid network – a deployment that the company had every right to pursue as it was entirely consistent with FCC rules – would have resulted in catastrophic interference to wireless medial telemetry services ("WMTS") in the adjacent band. TerreStar conducted extensive testing and concluded that its planned smart grid deployment and WMTS were fundamentally incompatible, jeopardizing life critical patient monitoring networks at thousands of registered health care facilities across the country. As acknowledged in the

[1] *See* Letter from Bryan Tramont, Counsel for TerreStar, to Marlene Dortch, Secretary, WT Docket No. 16-290 (filed July 17, 2018).

meeting, this interference was based on WMTS equipment receiving emissions from within TerreStar's primary band and not an out-of-band emission.

As we discussed, no amount of due diligence by TerreStar could have uncovered the WMTS interference issues as it was working to deploy smart grid technology. WMTS receivers were only certified beginning in 2011, and only then with wide passband filters to enable life-critical monitoring of medical patients. TerreStar could not have known that the manner in which WMTS developed their receivers would make them vulnerable to interference from an entirely compliant operation in the adjacent band. And no exclusion zones or other mitigation efforts could have addressed this interference problem that resulted from fundamental emissions to the WMTS band.[2]

Finally, we discussed that the need for additional spectrum for WMTS is undisputed, and that no entity is better situated to deploy this spectrum for WMTS quickly than TerreStar. TerreStar has committed to deploy to at least 50 large healthcare facilities within 18 months of grant of its Petition for Reconsideration and to all large healthcare facilities across the country within 36 months of grant. We encouraged OET to support the expeditious grant of the pending Petition for Reconsideration so that TerreStar can ensure that this critical, life-saving technology is available nationwide.

This letter is being filed electronically in accordance with Section l.1206(b)(1) of the Commission's rules.

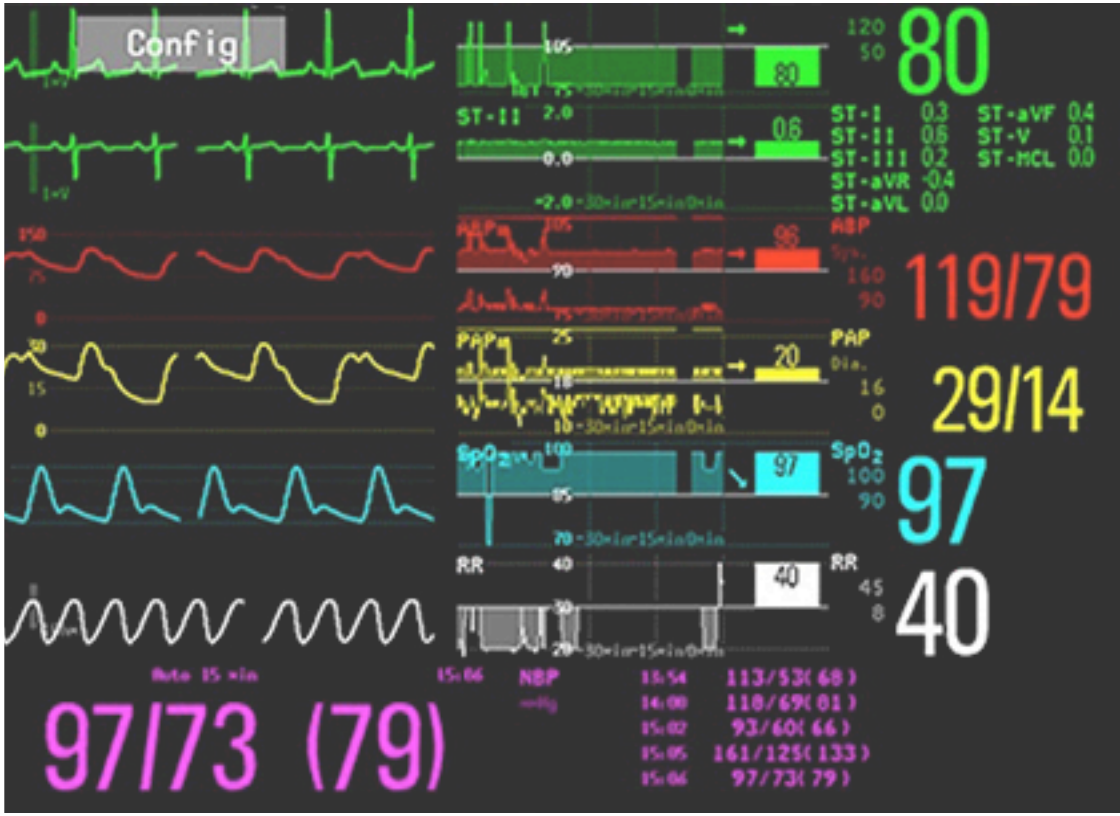
Sincerely,

Jennifer Tatel

Attachment

[2] *See TerreStar Corporation Request for Temporary Waiver of Substantial Service Requirements for 1.4 GHz Licenses*, Order, 32 FCC Rcd 7480, 7485 ¶ 12 (WTB 2017).

TerreStar



1.4 GHz Commercial and WMTS Co-Existence

Summary of Medical Telemetry Interference and Failure Analysis

Introduction

The 1.4 GHz commercial band (collectively 1390-1395 MHz / 1432-1435 MHz) is governed by Part 27 rules and permits both fixed high power and mobile use. Following acquisition of all licenses in the 1.4 GHz commercial band by TerreStar in 2008, the Company developed the band for Smart Grid operations. From 2009 through 2013, TerreStar produced a diverse FCC-certified Smart Grid transceiver ecosystem, completed a special 802.16 standard for high reliability utility operations (WiGRID), and began trial leasing of its spectrum to electrical utilities.

In late 2013, FCC staff met with TerreStar and urged the Company to address potential interference concerns with users of the Wireless Medical Telemetry Service (WMTS) in immediately adjacent 1.4 GHz spectrum (collectively 1395-1400 MHz / 1427-1432 MHz). Following this, major medical device manufacturers informed TerreStar that its planned Smart Grid networks were potentially incompatible with WMTS, posing a serious risk to patient safety. Though TerreStar was fully compliant with Part 27 rules, WMTS interests warned that the Company's Smart Grid emissions would likely impair or even disable life-critical patient monitoring networks at thousands of hospital deployments across the United States.

TerreStar responded to the concerns of the FCC and WMTS community by immediately commissioning a technical study of the possible interference problems. This study had three objectives:

① **Define Impact of 1.4 GHz Smart Grid Emissions to WMTS Operation** – Evaluate the interference susceptibility of commonly deployed WMTS network receivers to emissions from Smart Grid transmitters certified for use in the commercial 1.4 GHz band.

② **Understand Technical Basis for WMTS Vulnerability to Smart Grid Emissions** – If commonly deployed WMTS network receivers show significant susceptibility to interference from commercial 1.4 GHz emissions, determine if hardware issues are the cause.

③ **Determine if WMTS Vulnerability is Due to Regulatory Non-Compliance** – If commonly deployed WMTS network receivers show significant susceptibility to interference from commercial 1.4 GHz emissions, determine if non-compliance with FCC or FDA regulations is the cause.

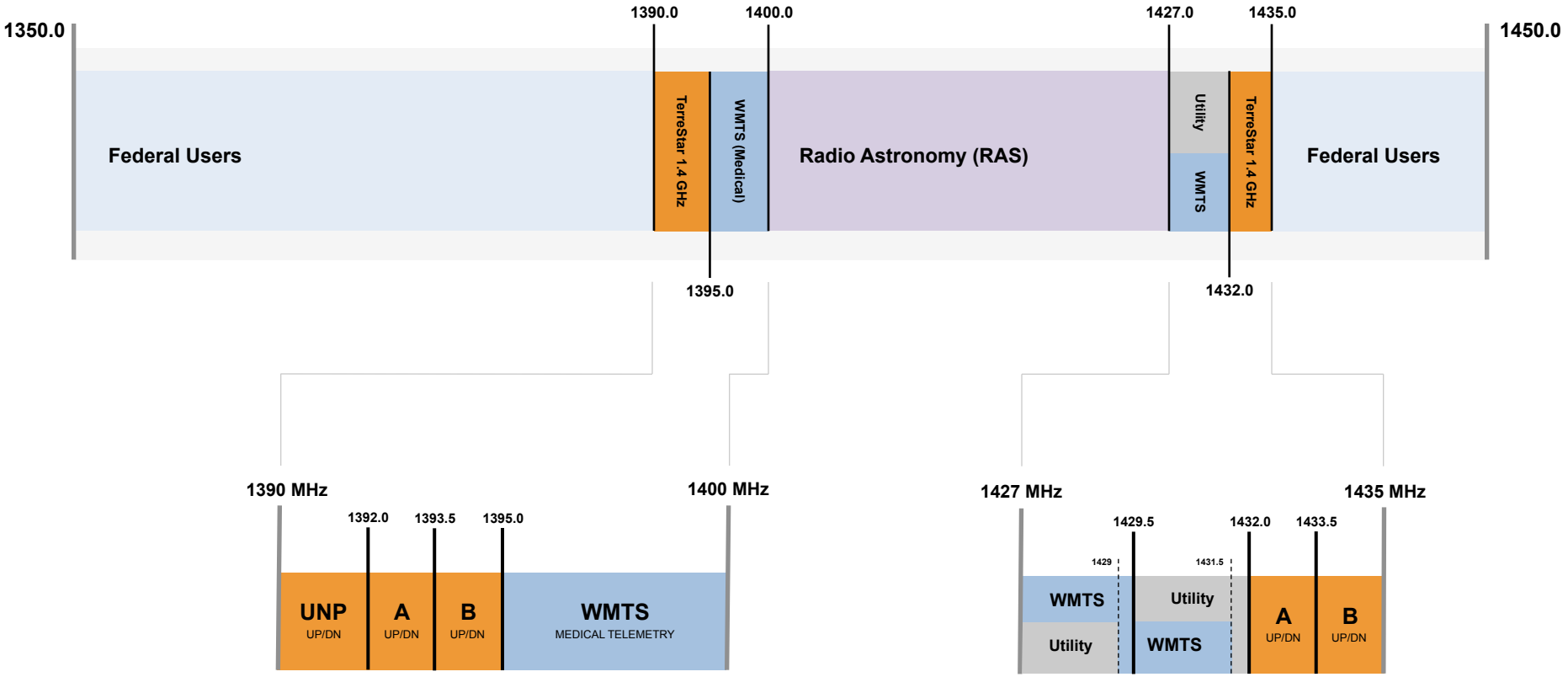
The following presentation is a brief summary of TerreStar's initial technical study regarding 1.4 GHz WMTS interference, which was completed in 2014. Based on the conclusions of this study, TerreStar was forced to suspend Smart Grid service deployment.

Contents

I: Incompatibility Between 1.4 GHz Commercial and WMTS Networks

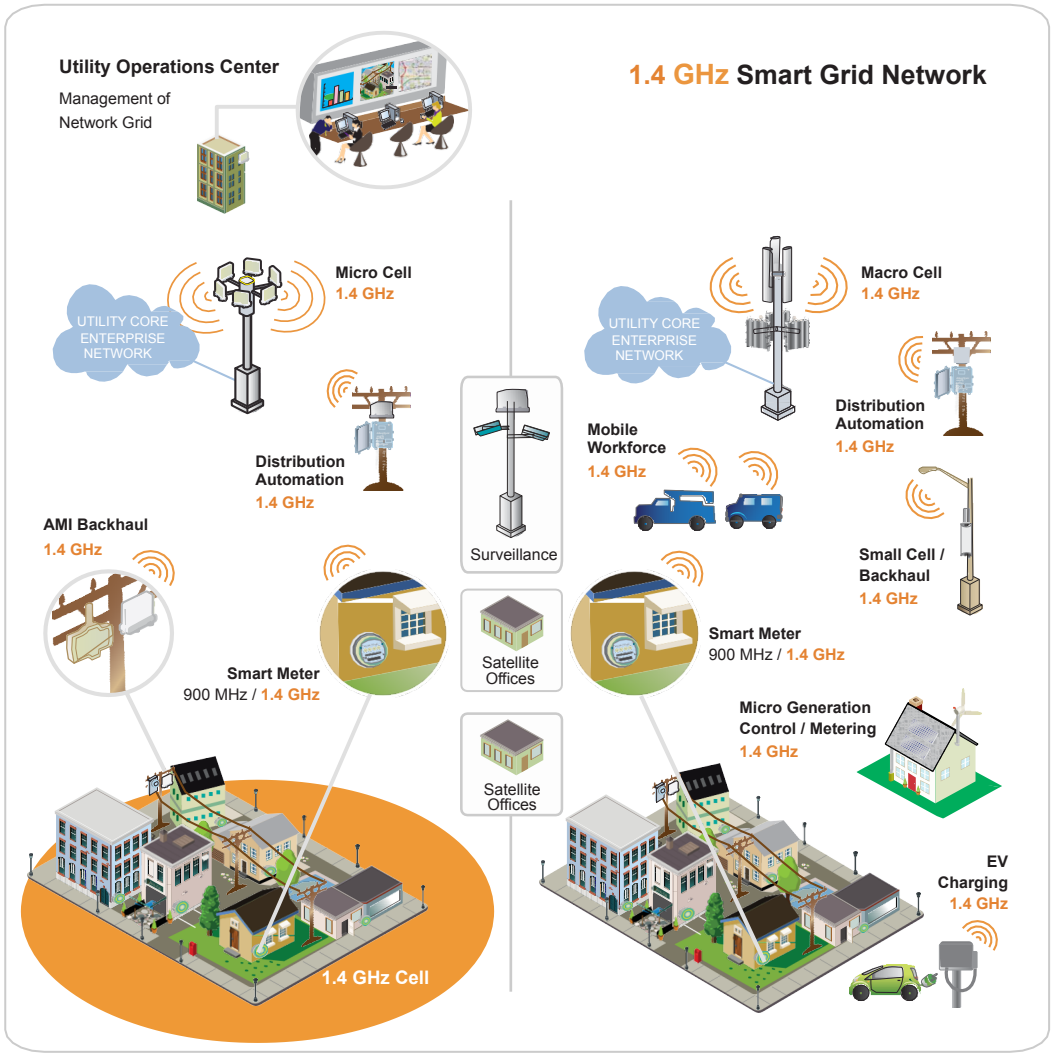
Immediately Adjacent 1.4 GHz Commercial and WMTS Allocations

The 1.4 GHz commercial and WMTS allocations sit directly adjacent to one another. Despite special emissions rules applied to the commercial band, the unforeseeable limited receiver selectivity of WMTS networks created a serious vulnerability in life-critical medical system operation.



Commercial Smart Grid Networks at 1.4 GHz

Smart Grid has become a central element in electrical utility modernization. TerreStar's 1.4 GHz spectrum was the only nationwide licensed broadband allocation suitable for Smart Grid service, and the Company had developed a full FCC-certified ecosystem for Smart Grid.



1.4 GHz Smart Grid Ecosystem

Base Station
Airspan MicroMAX

Mobile CPE
Airspan MRT

Portable Dongle
Airspan MiMAX

Indoor CPE
Airspan MiMAX Easy

Indoor / Outdoor Cell
Airspan MiMAX Pro

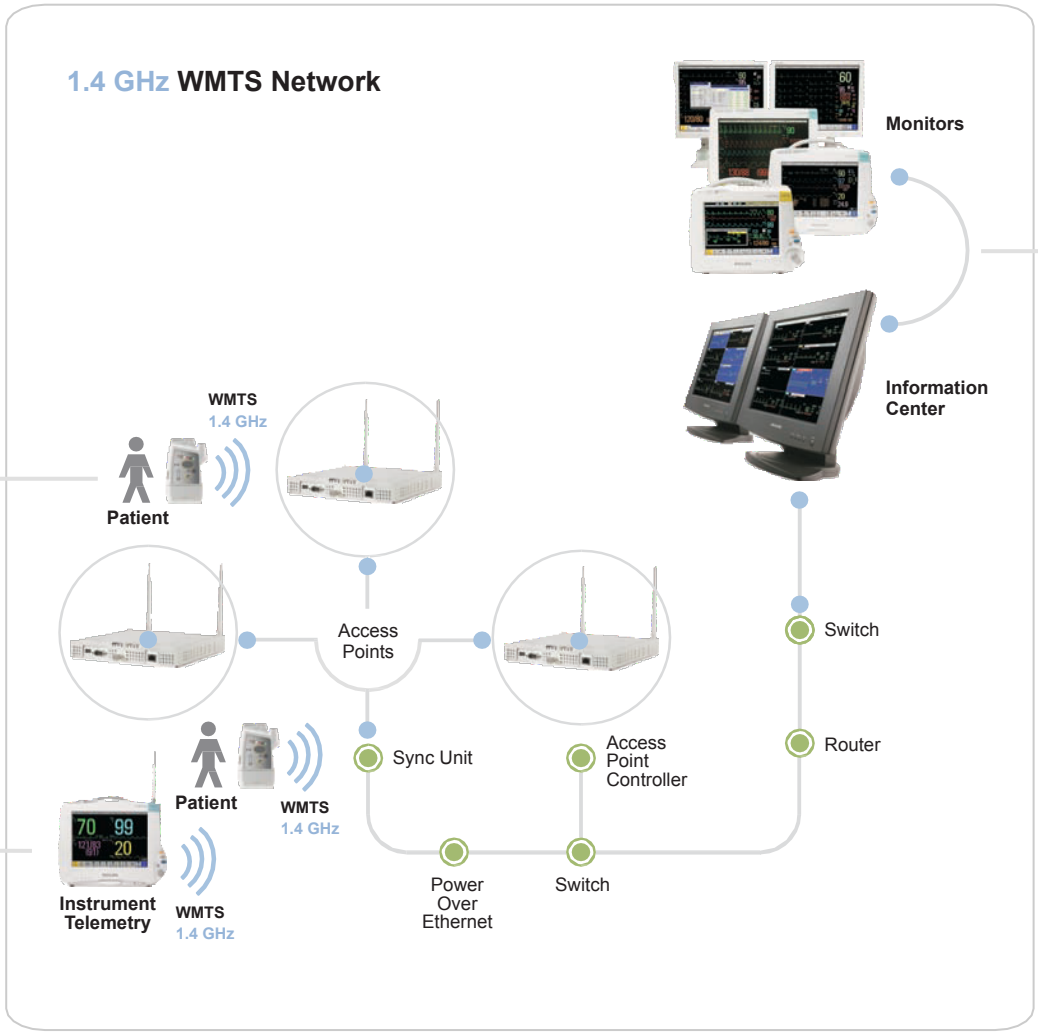
Base Station
Airspan Air4G

Base Station / Backhaul
Airspan AirSynergy

Base Stations / Nodes
Cisco Connected Grid

Wireless Medical Telemetry Service Networks at 1.4 GHz

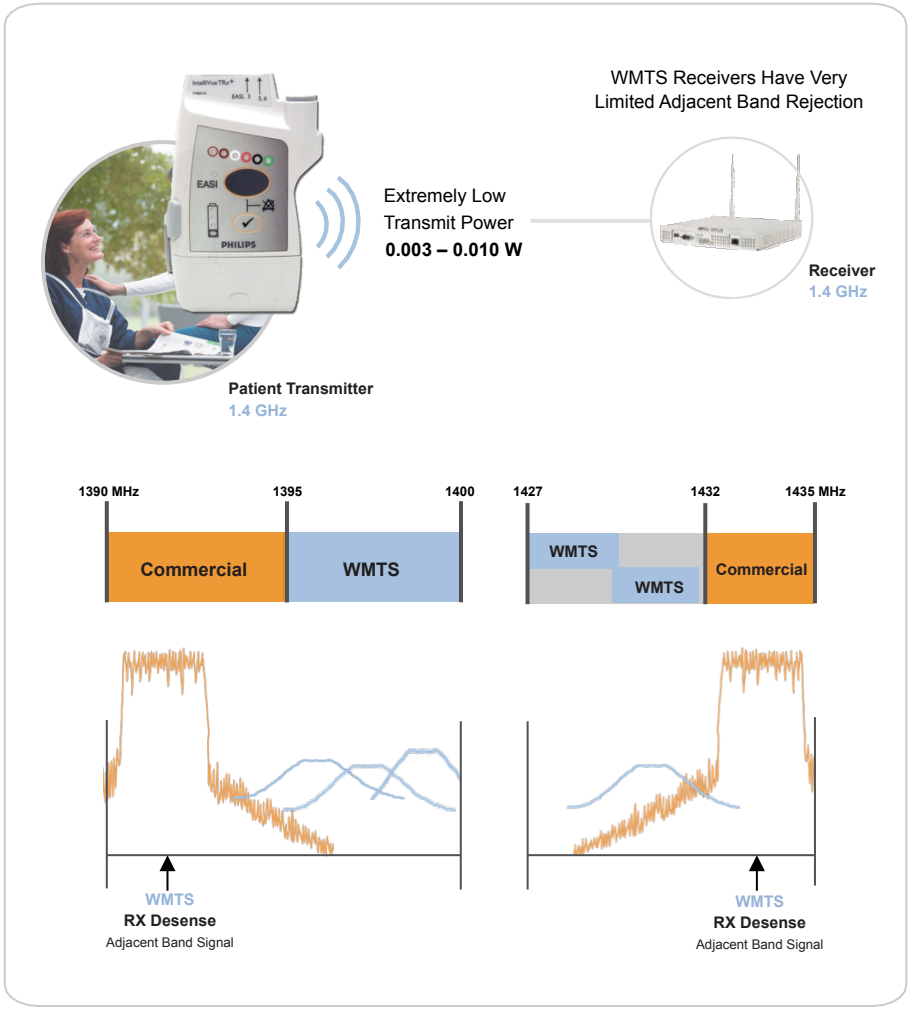
WMTS systems operating in the 1.4 GHz band provide life-critical services by enabling real-time monitoring for high-risk patients. Growing rapidly since the first deployment in 2010, WMTS now has approximately 8,500 deployments at major healthcare facilities across the US.



Real Time Patient Vitals Monitoring

Vulnerability of 1.4 GHz WMTS Networks to Smart Grid Network Interference

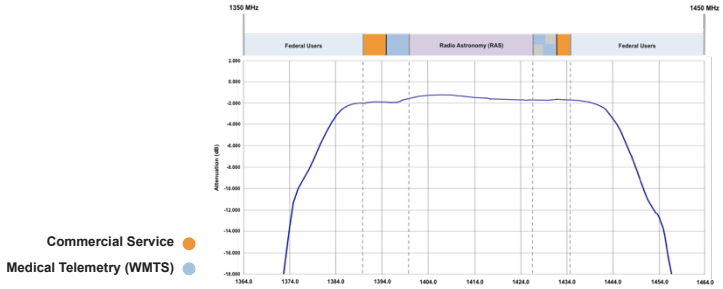
WMTS systems were designed with receivers that offer very little protection from adjacent band commercial emissions. This created an unforeseeable interference problem as TerreStar began deploying Smart Grid networks in the immediately adjacent commercial allocation.



II: Technical Roots of 1.4 GHz WMTS Network Vulnerability

Technical Roots of 1.4 GHz WMTS Network Vulnerability

Passband filtration in the WMTS receiver extends well into the adjacent commercial allocation, causing the fundamental emissions in that allocation to interfere with WMTS. Even fully rule compliant commercial operations thus represent a danger to patient safety.



- WMTS receiver passband extends into commercial spectrum.
- Fundamental commercial emission overloads WMTS receiver.

WMTS
1.4 GHz

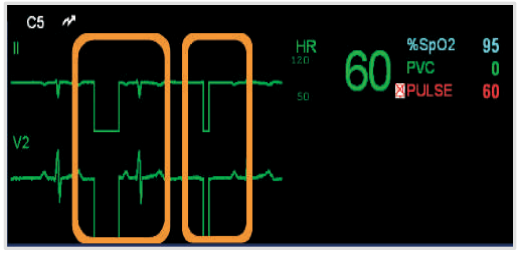
Patient

Receiver
1.4 GHz

Information Center

Base Station
1.4 GHz

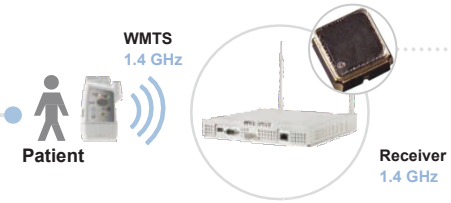
Terminal
1.4 GHz

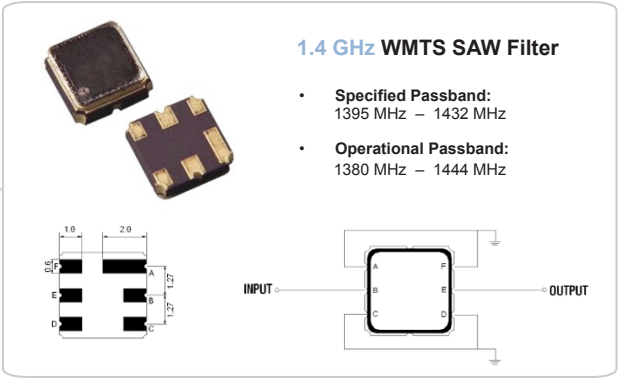


- Minimal interference results in patient data dropouts.
- Strong interference from adjacent band commercial service can disable patient monitoring.

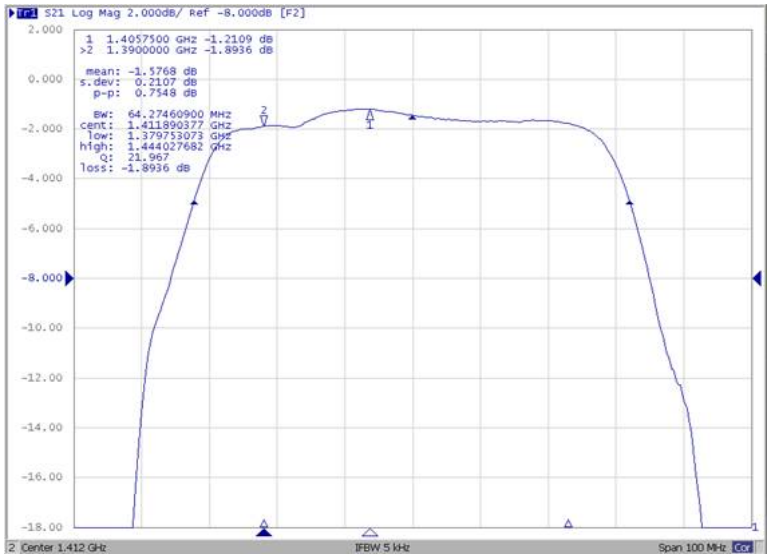
Wideband SAW Filter in Common Use by 1.4 GHz WMTS Receivers

WMTS receivers employ Surface Acoustic Wave (SAW) filters to protect desired emissions from adjacent band interference. SAW filters in commonly deployed 1.4 GHz WMTS equipment, however, are wide-banded and apply no attenuation to TerreStar's 1.4 GHz allocation.





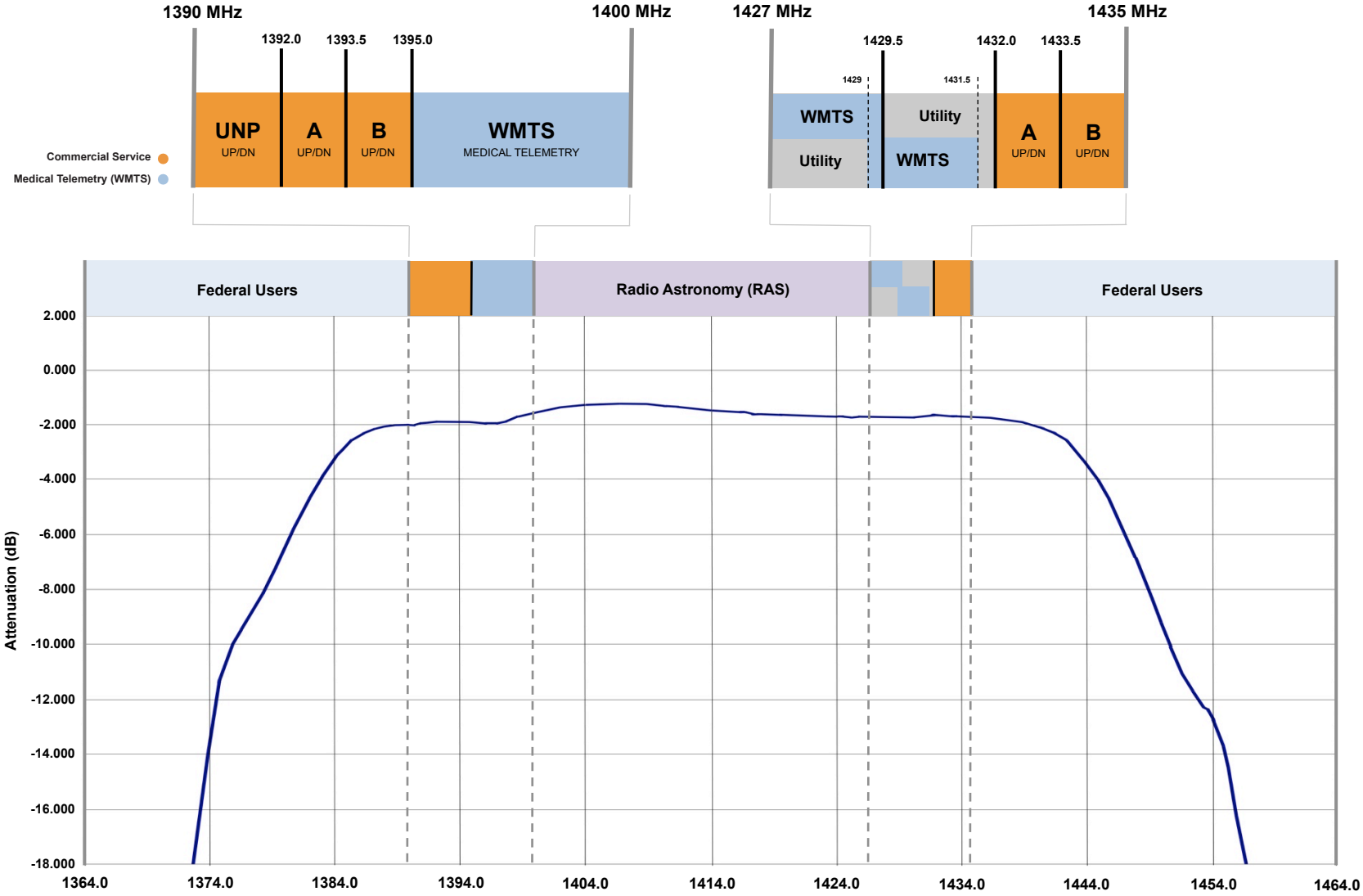
1.4 GHz **WMTS SAW Filter Passband** (CF: 1412 MHz / SPAN: 100 MHz)



1.4 GHz **WMTS SAW Filter Passband** (CF: 1412 MHz / SPAN: 300 MHz)

WMTS Receive Filter Passband Relative to 1.4 GHz Commercial Allocation

Passband filters in commonly deployed WMTS receivers exhibit insertion loss at TerreStar's 1.4 GHz frequencies comparable to that in the WMTS allocation they are designed to efficiently pass. This offers WMTS no protection from fundamental emissions in the TerreStar band.



III: FCC Rules Governing 1.4 GHz Commercial and WMTS Networks

FCC Emissions Rules for 1.4 GHz Commercial and WMTS Networks

Emissions rules for 1.4 GHz commercial and WMTS operations are governed by Parts 27 and 95, respectively. WMTS networks are limited to extremely low powers via a 740 mV/m at 3m field strength limit. There are no performance or certification requirements for WMTS receivers.

1.4 GHz Commercial Emissions Rules

Part 27.50: Power Limits and Duty Cycle

(e) The following power limits apply to the paired 1392-1395 MHz and 1432-1435 MHz bands as well as the unpaired 1390-1392 MHz band:

(1) Fixed stations transmitting in the 1390-1392 MHz and 1432-1435 MHz bands are limited to 2000 watts EIRP peak power. Fixed stations transmitting in the 1392-1395 MHz band are limited to 100 watts EIRP peak power.

(2) Mobile stations transmitting in the 1390-1392 MHz and 1432-1435 MHz bands are limited to 4 watts EIRP peak power. Mobile stations transmitting in the1392-1395 MHz band are limited to 1 watt EIRP peak power.

Part 27.53: Emission Limits

For operations in the unpaired 1390-1392 MHz band and the paired 1392-1395 MHz and 1432-1435 MHz bands, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB.

Part 27.804: Field Strength Limits at WMTS Facility

(a) For any operation in the 1392-1395 MHz band, the predicted or measured field strength – into the WMTS band at 1395-1400 MHz – shall not exceed 150 uV/m at the location of any registered WMTS healthcare facility. When performing measurements to determine compliance with this provision, measurement instrumentation employing an average detector and a resolution bandwidth of 1 MHz may be used, provided it accurately represents the true interference potential of the equipment.

NOTE: Part 27 does not specify field strength limits for out of band emissions into the WMTS bands from fundamental emissions in the 1390-1392 MHz and 1432-1435 MHz bands.

1.4 GHz WMTS Emissions Rules

Part 95.2369: WMTS Field Strength Limits

(b) For WMTS transmitter types operating in the 1395-1400 MHz and 1427-1432 MHz bands, the field strength of the transmitted signal must not exceed 740 mV/m, measured at 3 meters, using instrumentation with an averaging detector and a 1 MHz reference bandwidth.

Part 95.2385: WMTS RF Exposure Evaluation

Portable devices as defined in Part 2.1093(b) of this chapter operating in the WMTS are subject to radio frequency radiation exposure requirements as specified in Parts 1.1307(b) and 2.1093 of this chapter. Applications for equipment authorization of WMTS devices must contain a statement confirming compliance with these requirements. Technical information showing the basis for this statement must be submitted to the Commission upon request.

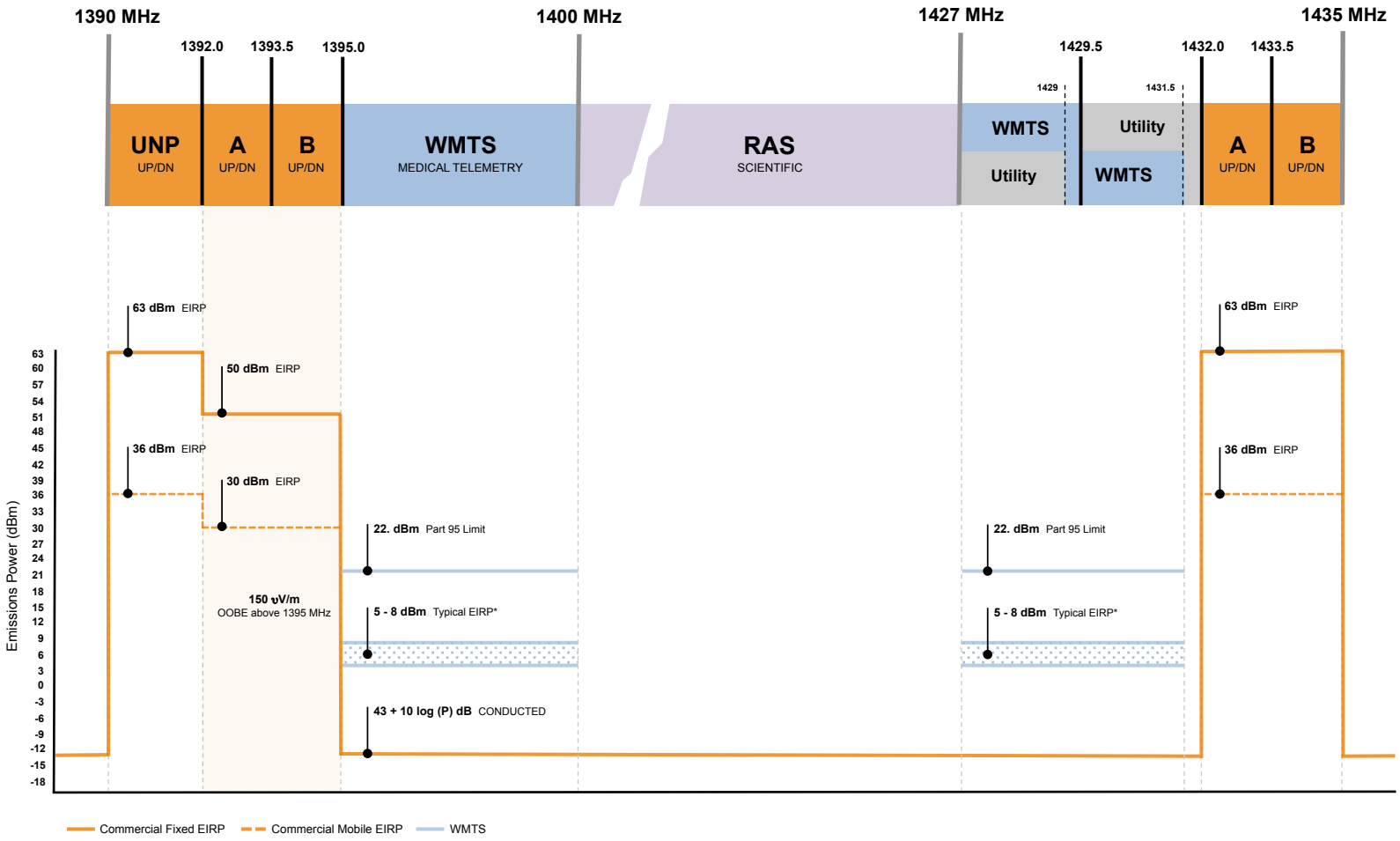
Part 95.2361: WMTS Transmitter Certification

(a) WMTS transmitters (transmitters that operate or are intended to operate in the WMTS) must be certified in accordance with this subpart and the provisions of part 2, subpart J of this chapter.

NOTE: Part 95 does not require certification or any other form of demonstration or reporting of WMTS receiver performance.

Graphical Summary of FCC Emissions Rules for 1.4 GHz Commercial and WMTS Networks

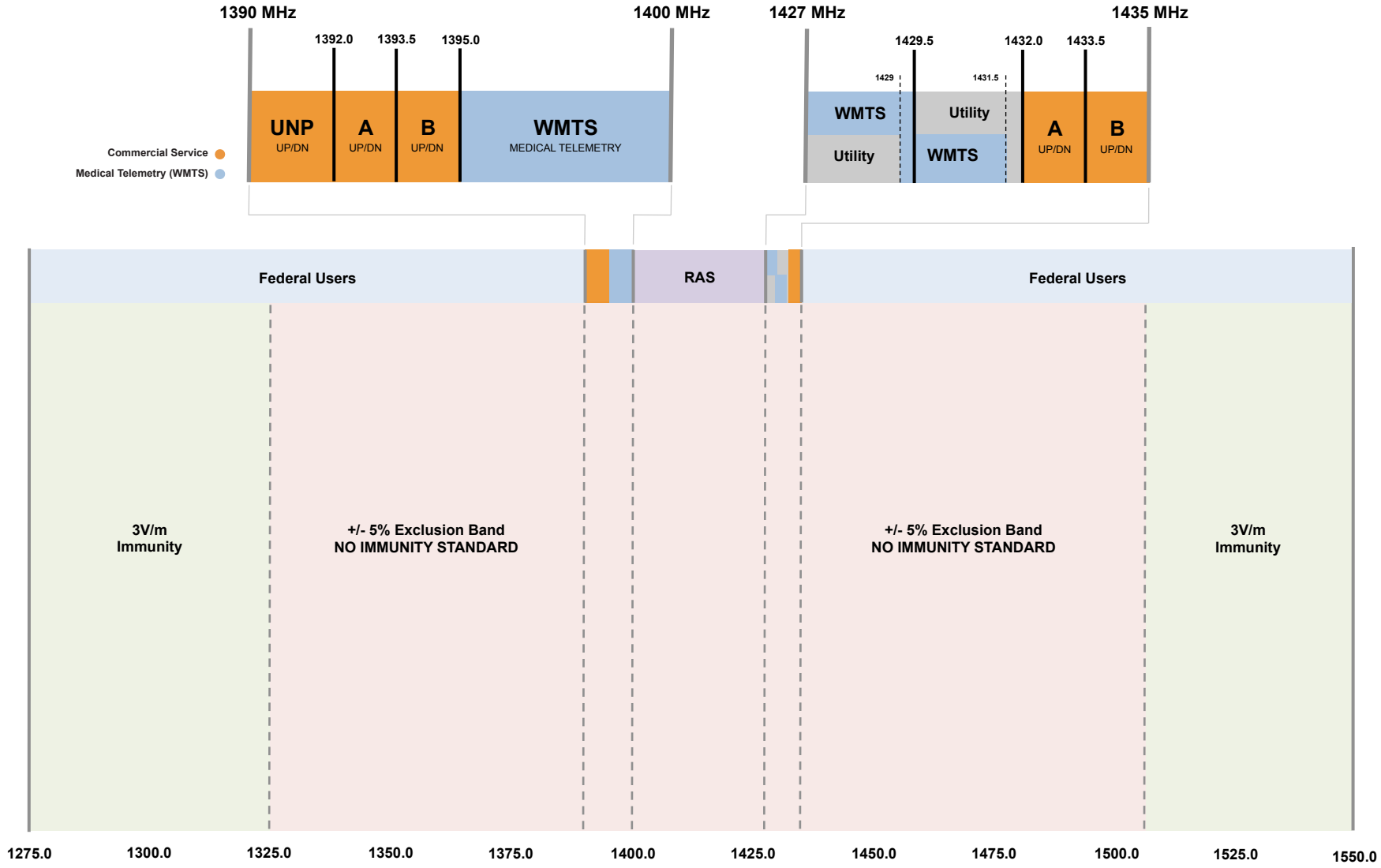
Commercial 1.4 GHz services may emit up to 63 dBm EIRP (36 dBm EIRP for mobile). Lower A+B block power is limited to 50 dBm EIRP (30 dBm EIRP for mobile) with a 150 uV/m OOBE field strength inside registered hospitals. These limits offer no practical protection to WMTS.



*Battery life and SAR compliance typically limit WMTS transmitters to < 8 dBm EIRP.

IEC 60601-1-2 Medical Device Interference Immunity Standard

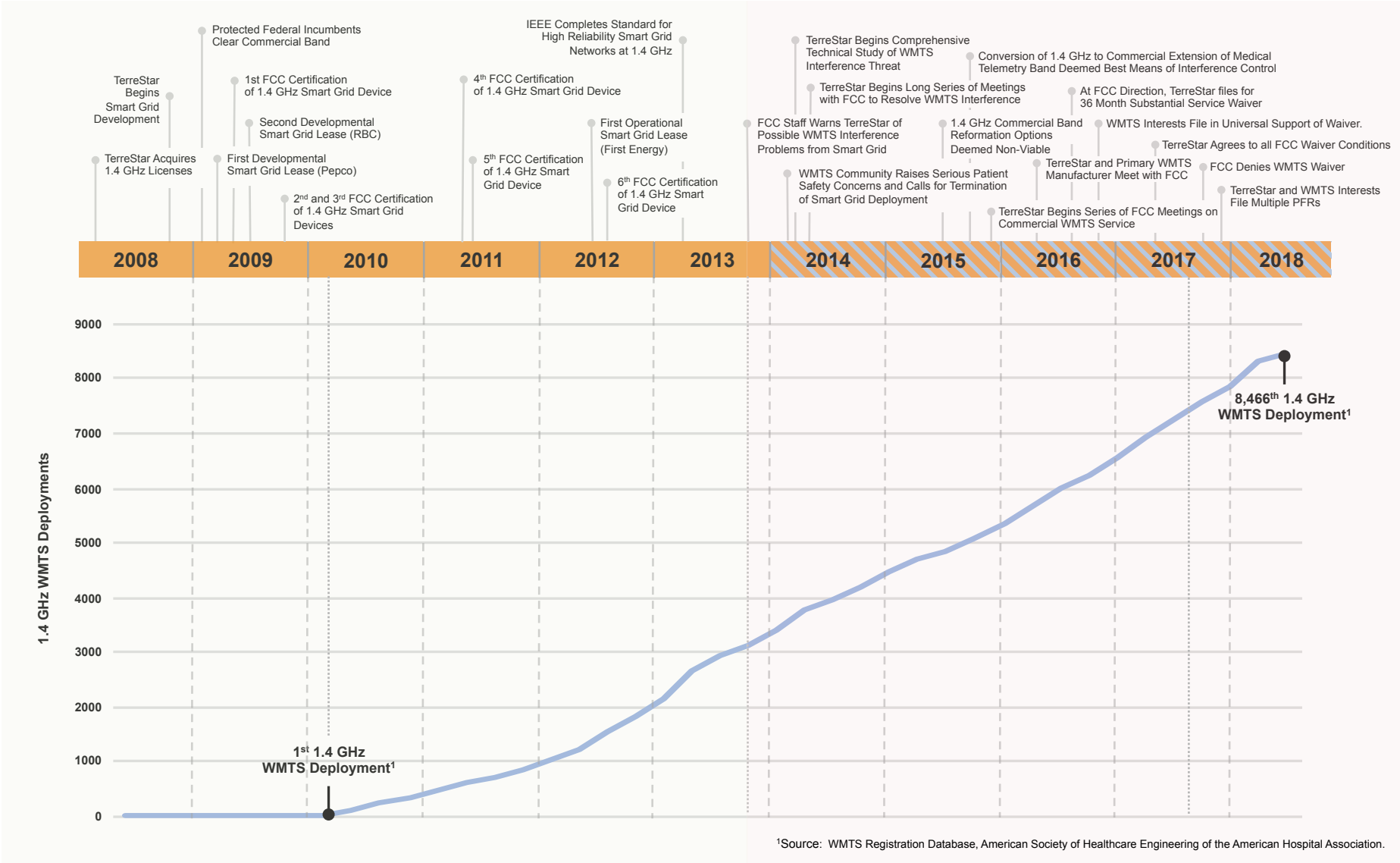
FDA assessment of medical devices relies upon compliance with IEC 60601-1-2 standards for RF interference immunity across 80-2000 MHz. While 1.4 GHz WMTS hardware is IEC compliant, the permitted “exclusion band” requires no interference immunity from commercial 1.4 GHz.



IV: Development Timeline of 1.4 GHz Commercial and WMTS Networks

Coincident Timeline of Commercial and WMTS Networks

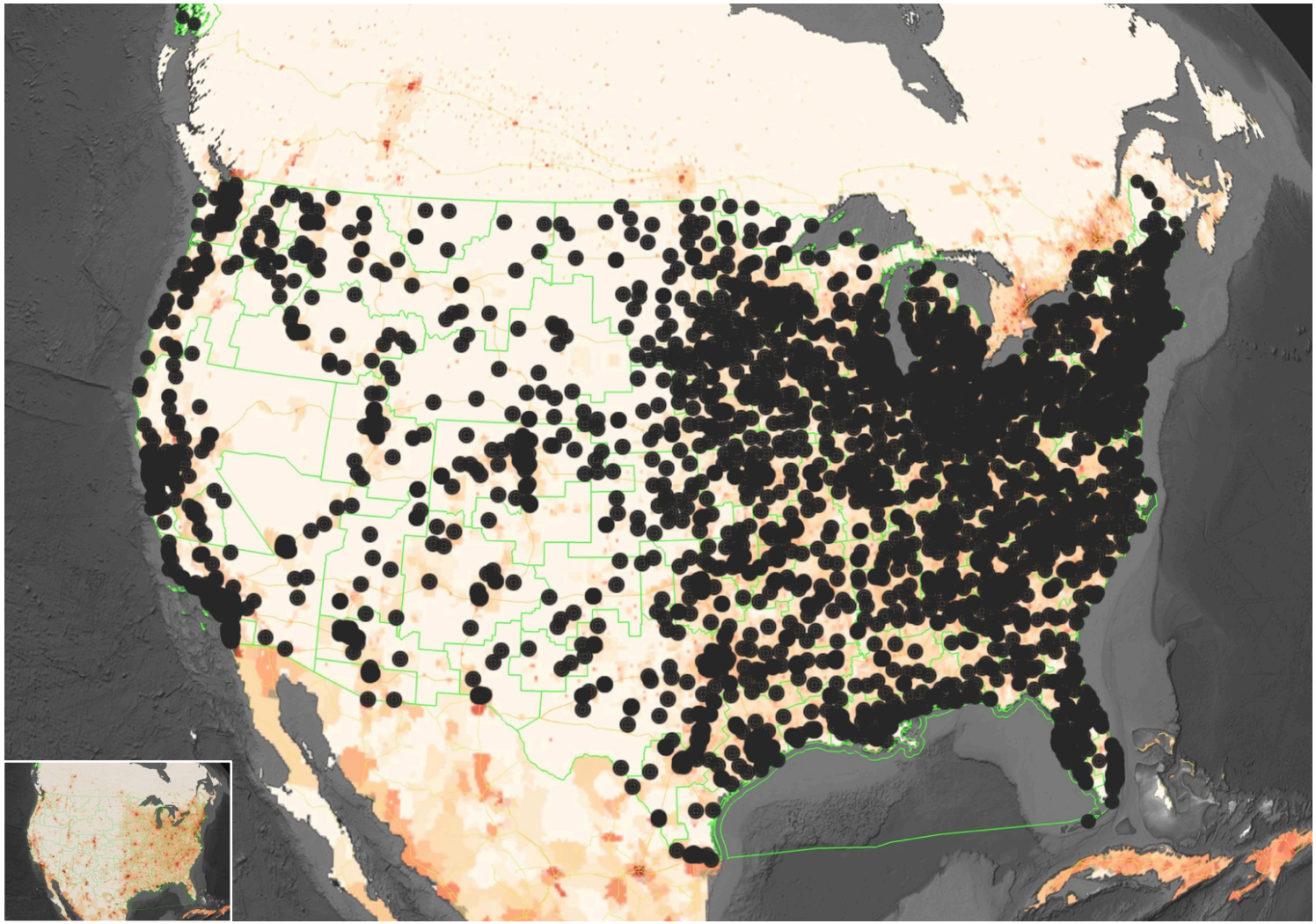
When TerreStar acquired its licenses and began certifying devices for the 1.4 GHz commercial band, no WMTS deployments had yet occurred. Neither service could have foreseen the interference problems that would result from the rapid growth of WMTS after 2010.



[1]Source: WMTS Registration Database, American Society of Healthcare Engineering of the American Hospital Association.

Geographic Distribution of 1.4 GHz WMTS Network Deployments

As of May 2018, 8,466 1.4 GHz WMTS network deployments were operational across the United States. According to ASHE, 1.4 GHz WMTS network deployments are growing at a rate of approximately 20% per annum. They exist in every significant domestic population zone.



1.4 GHz WMTS Deployments

Deployment Count: 8,466 Networks

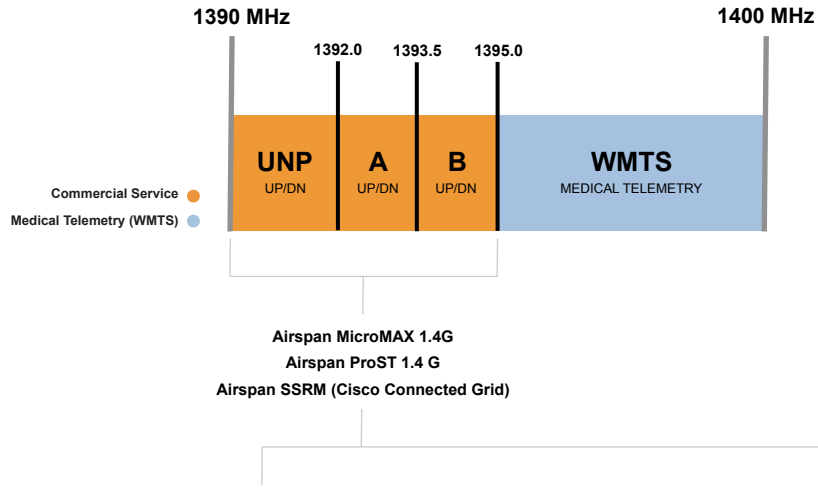
Date of Last Update: May 2018

NOTE: Map points represent multiple 1.4 GHz WMTS network deployments.

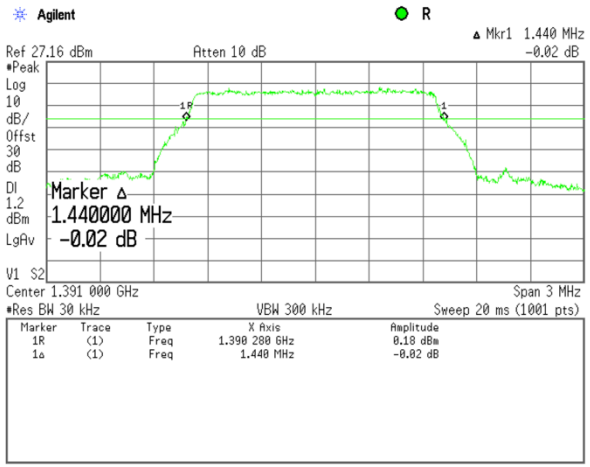
V: 1.4 GHz Commercial to WMTS Interference Analysis

Typical Emissions of FCC Certified 1.4 GHz Commercial Devices – Lower Band

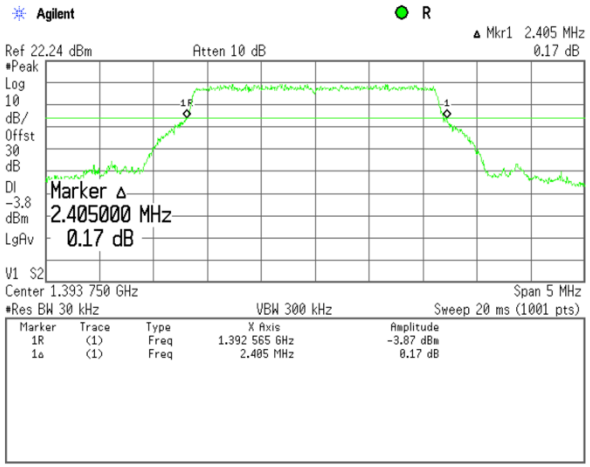
TerreStar and its partners created a full Smart Grid ecosystem for the 1.4 GHz commercial band. The FCC certified devices for the lower 1.4 GHz band between 2009 and 2012. Certified transceivers produce 802.16 emissions in 1.5 MHz, 3 MHz and 5 MHz channel widths.



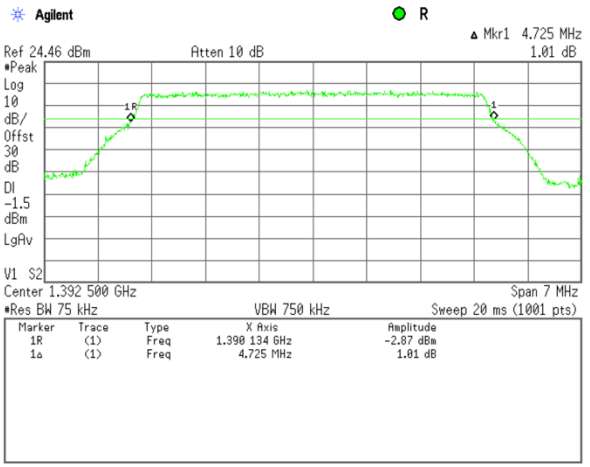
1.5 MHz Channel – UNP Block



3 MHz Channel – Lower A/B Blocks

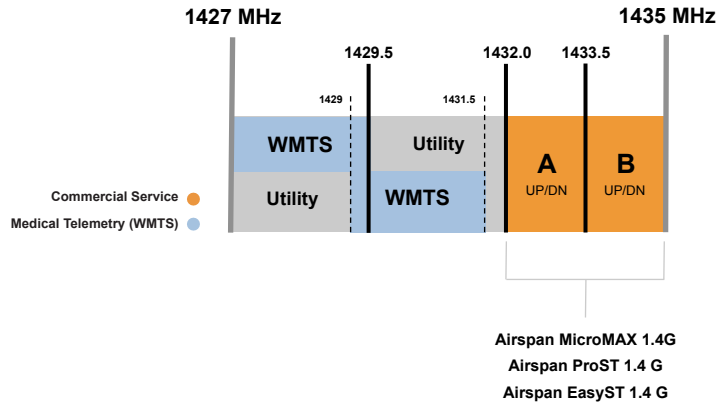


5 MHz Channel – UNP + Lower A/B Blocks



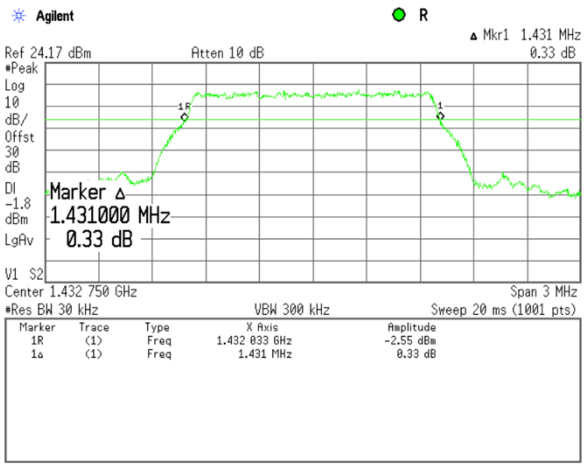
Typical Emissions of FCC Certified 1.4 GHz Commercial Devices – Upper Band

The FCC certified devices for the upper 1.4 GHz band between 2009 and 2012. Certified transceivers produce 802.16 emissions in 1.5 MHz, 3 MHz and 5 MHz (lower band) channel widths.

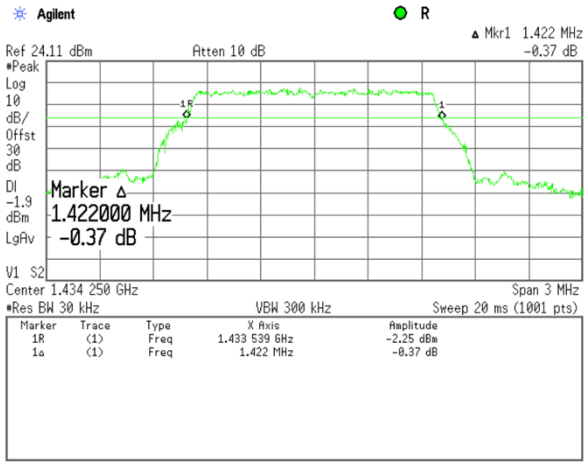


Airspan MicroMAX 1.4G
Airspan ProST 1.4 G
Airspan EasyST 1.4 G

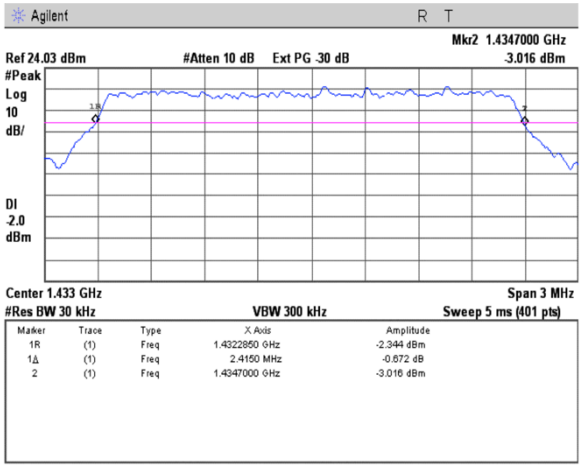
1.5 MHz Channel – Upper A Block



1.5 MHz Channel – Upper B Block

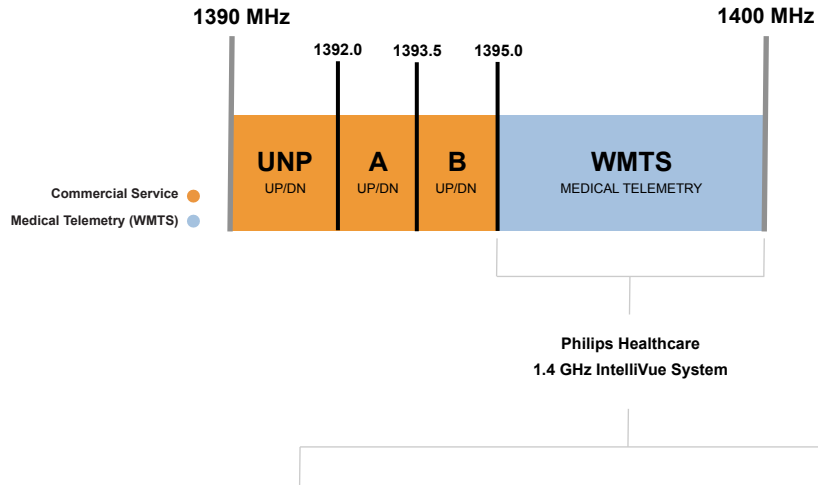


3 MHz Channel – Upper A/B Blocks

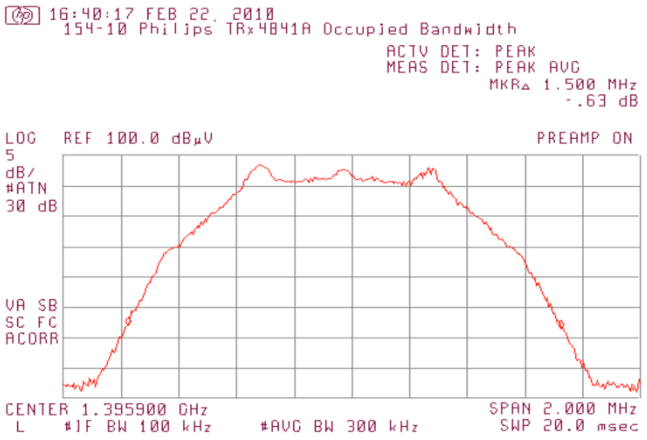


Typical Emissions of FCC Certified 1.4 GHz WMTS Devices – Lower Band

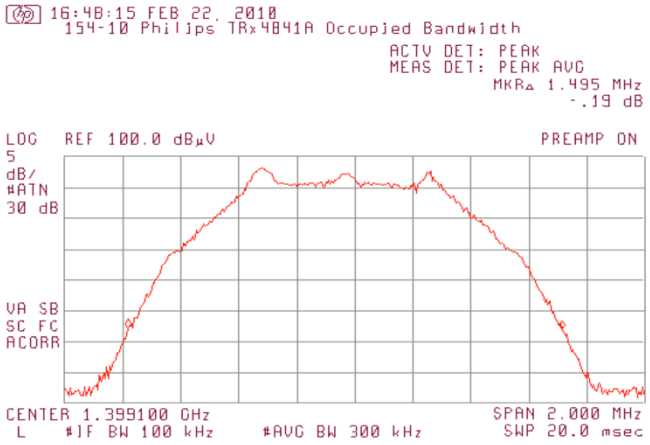
Several medical device manufacturers have received FCC certification for WMTS transceivers. Philips Healthcare produced devices represent the overwhelming bulk of WMTS deployments. These devices produce DECT emissions in 1.6 MHz channels (three lower band channels).



1.6 MHz Channel – Channel 1

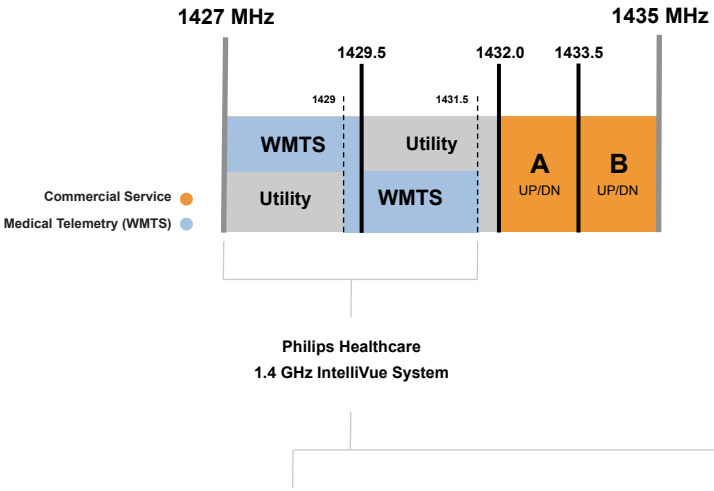


1.6 MHz Channel – Channel 3

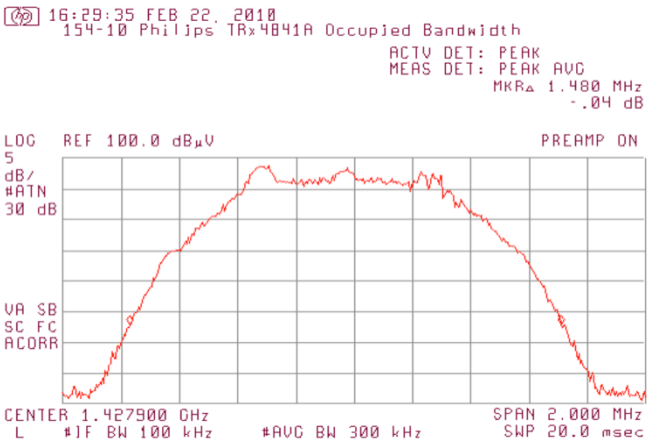


Typical Emissions of FCC Certified 1.4 GHz WMTS Devices – Upper Band

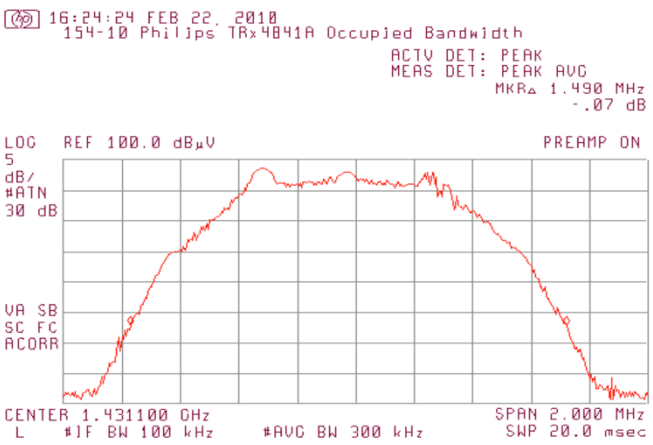
Several medical device manufacturers have received FCC certification for WMTS transceivers. Philips Healthcare produced devices represent the overwhelming bulk of WMTS deployments. These devices produce DECT emissions in 1.6 MHz channels (one upper band channel).



1.6 MHz Channel – Channel 4

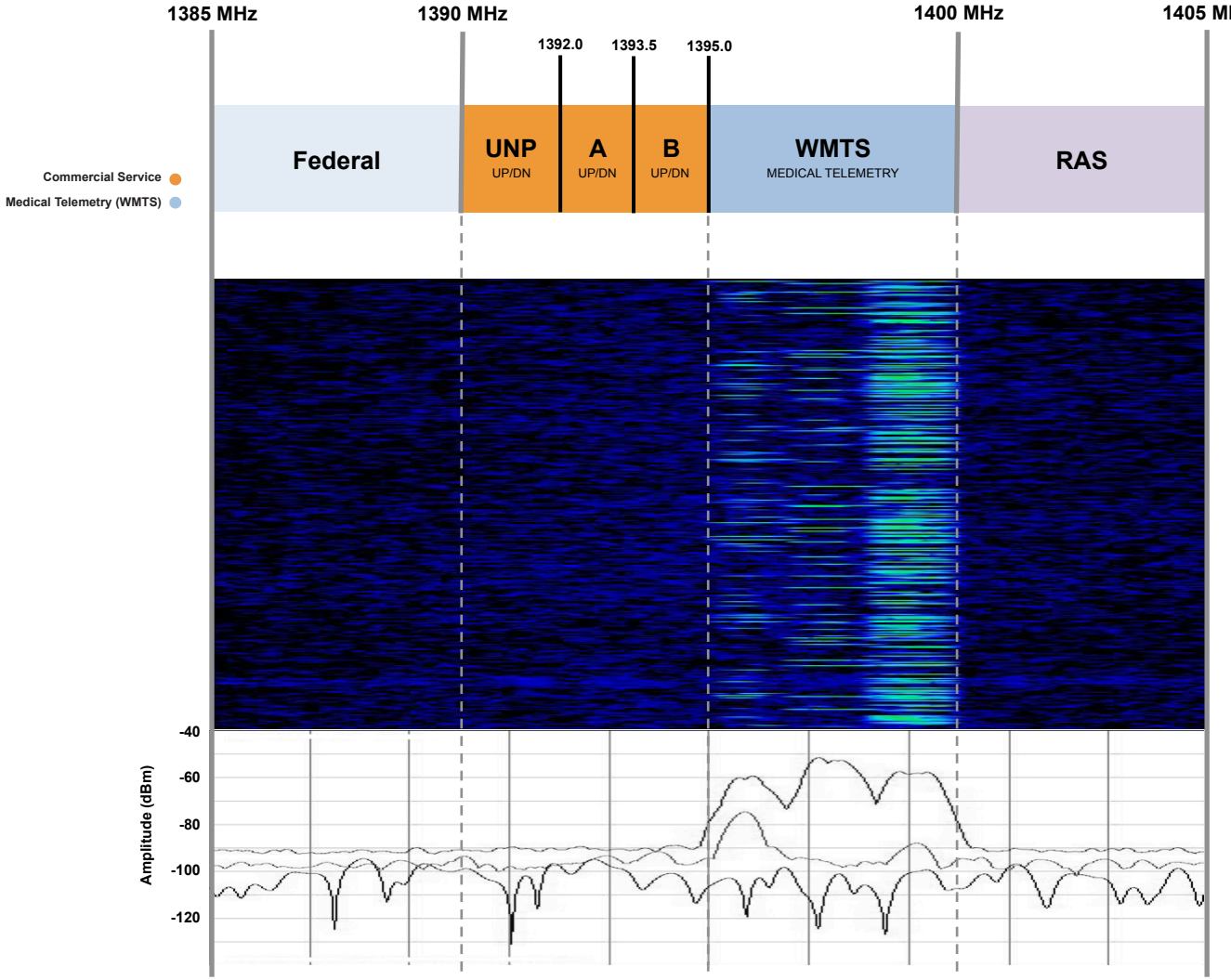


1.6 MHz Channel – Channel 6



Typical 1.4 GHz WMTS Spectrum Conditions – Lower Band

TerreStar measurements of lower band 1.4 GHz WMTS activity at hospitals in May 2014 indicated a weak signal service nearing capacity. Neither WMTS hardware nor network deployments were designed to cope with strong signals from adjacent band commercial services.

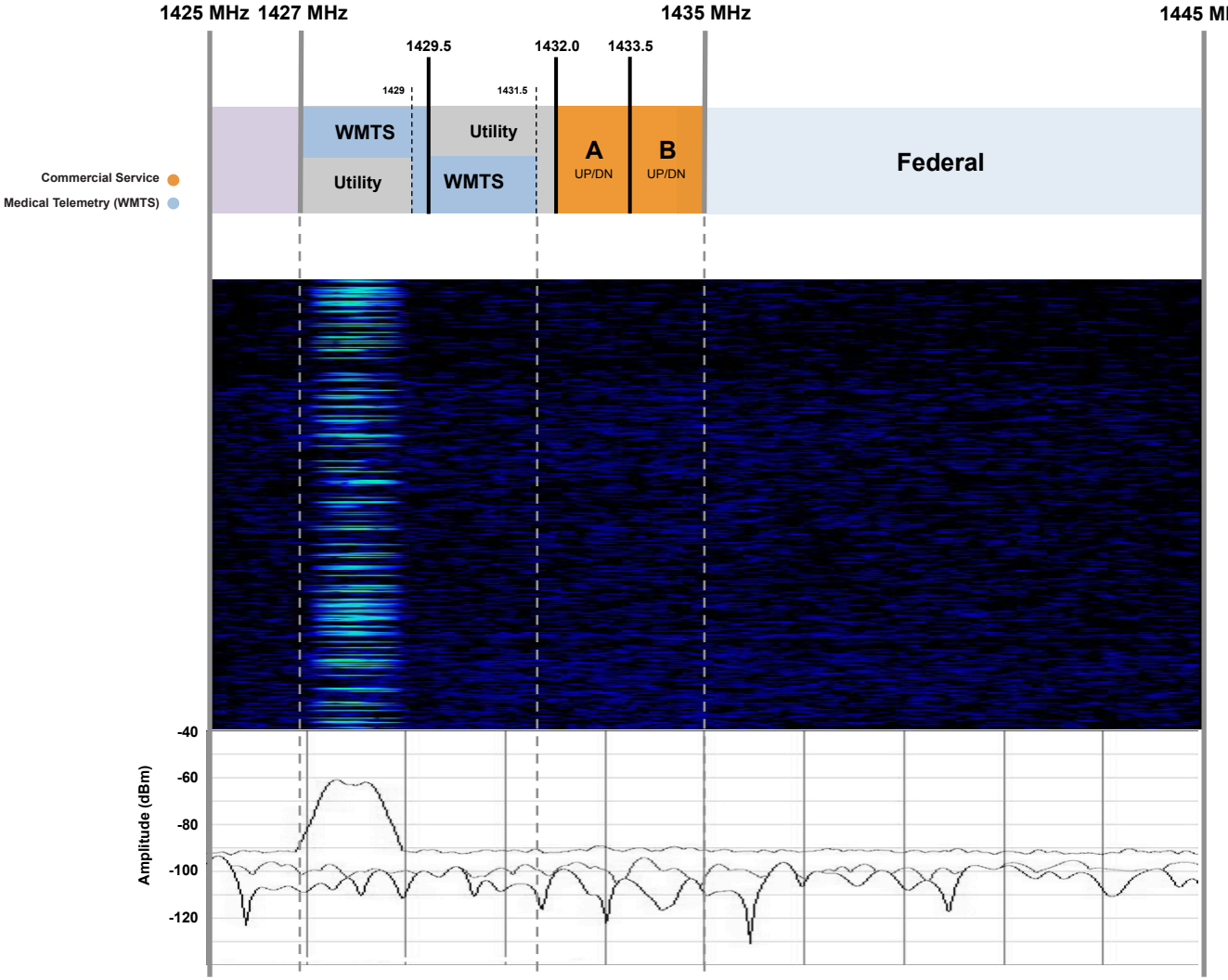


2D SPECTROGRAM

Location (Facility): St. Elizabeth Medical Center
Location (City): Boston, MA
Location (Coordinates):: 42.349022° -71.148236°
Frequency: 1385 - 1405 MHz
Analyzer: RSA 306
Antenna: OmniLOG 70600
Date: 30 May 2014

Typical 1.4 GHz WMTS Spectrum Conditions – Upper Band

TerreStar measurements of upper band 1.4 GHz WMTS activity at hospitals in May 2014 indicated a weak signal service nearing capacity. Neither WMTS hardware nor network deployments were designed to cope with strong signals from adjacent band commercial services.

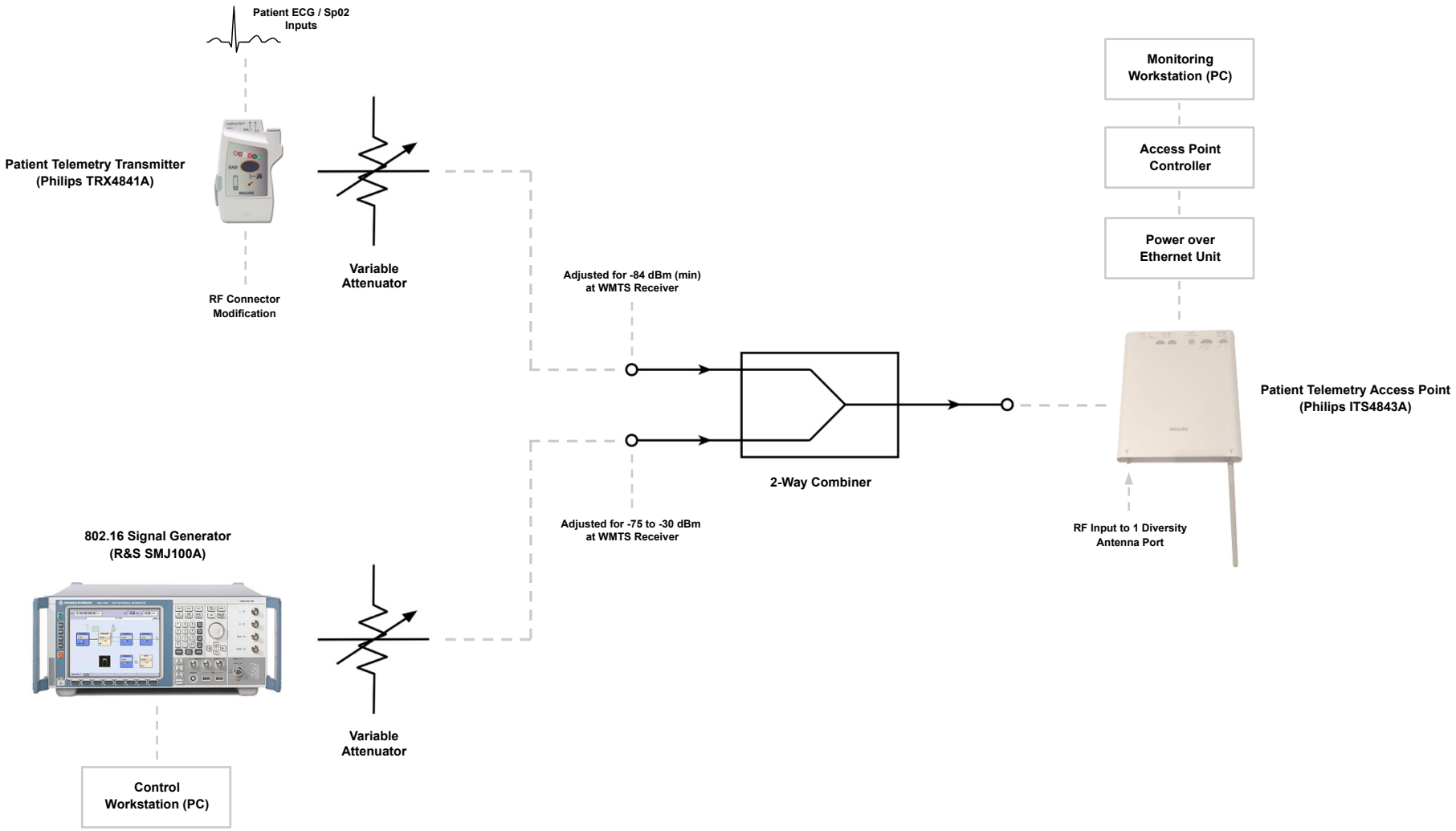


2D SPECTROGRAM

Location (Facility): St. Elizabeth Medical Center
Location (City): Boston, MA
Location (Coordinates):: 42.349022° -71.148236°
Frequency: 1425 - 1445 MHz
Analyzer: RSA 306
Antenna: OmniLOG 70600
Date: 30 May 2014

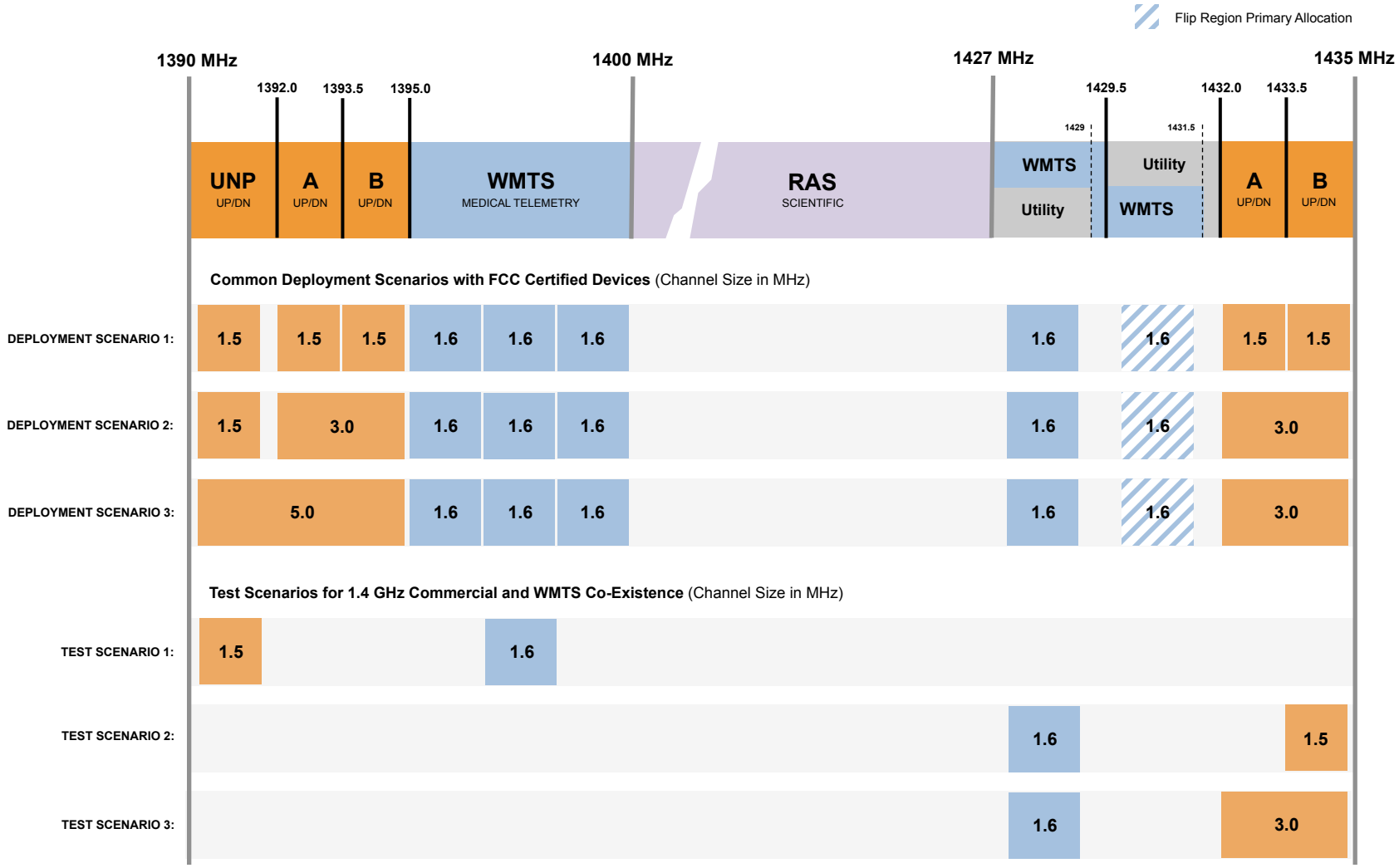
Original 1.4 GHz Commercial to WMTS Conducted Interference Tests

Following serious patient safety warnings from WMTS device manufacturers in 2014, TerreStar began independent tests to verify the interference problem. Conducted tests used commonly deployed Philips WMTS hardware and assumed >3 dB margins on minimum operational sensitivity.



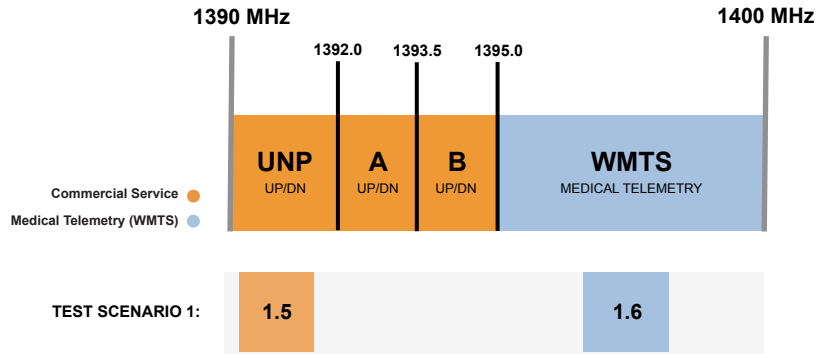
Operational Scenarios Studied in Conducted Interference Tests

While commercial and WMTS device certifications and deployments indicate full utilization of the upper and lower bands, initial testing considered only the impact of single commercial channels on single WMTS channels. Three such scenarios were analyzed.



Summary Results of Original Lower Band Conducted Tests

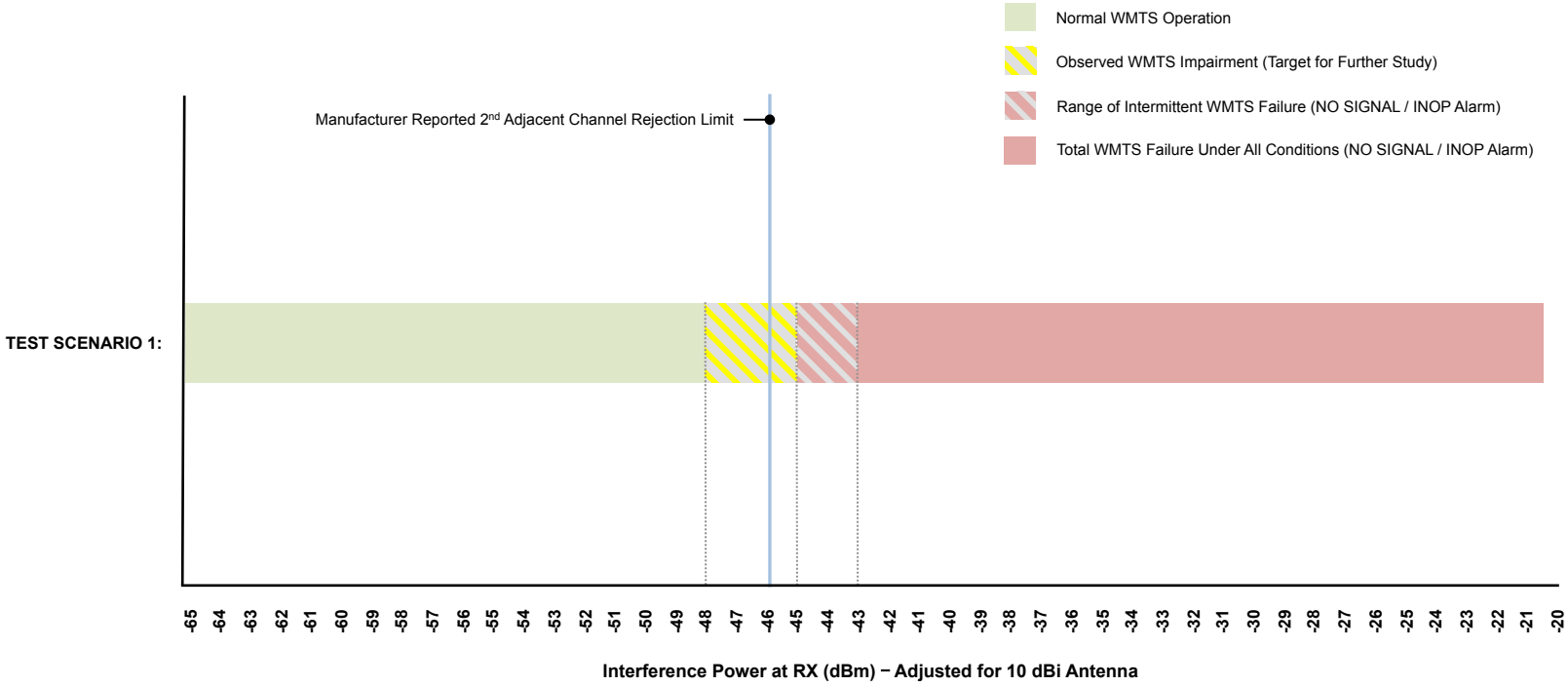
Conducted interference tests of the lower band were designed to indicate the incident power levels where WMTS operation was fully impaired. In Scenario 1, 32 test runs indicated onset of WMTS failure at interference power levels from -45 dBm to -43 dBm.



Lower Band Test Conditions:

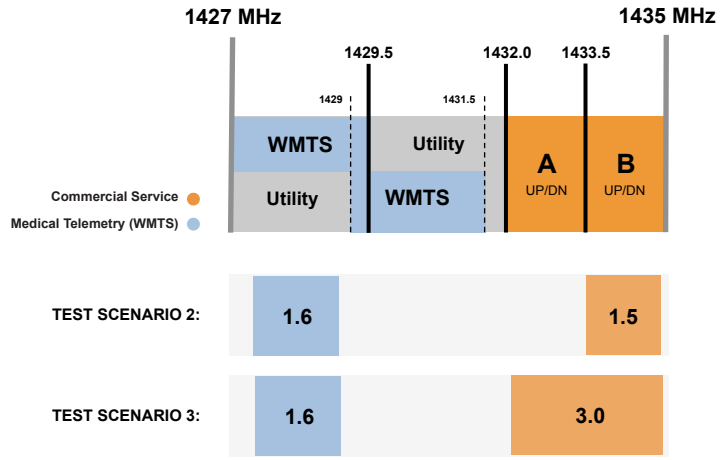
Interference Source: 1.5 MHz 802.16 Emission
Duty Cycle: ~60%
Incident Power at RX: -75 to -30 dBm

WMTS Source: 1.6 MHz DECT Emission (Channel 2)
Duty Cycle: Variable, ECG + Sp02 from single human subject.
Incident Power at RX: -84 dBm (minimum)



Summary Results of Original Upper Band Conducted Tests

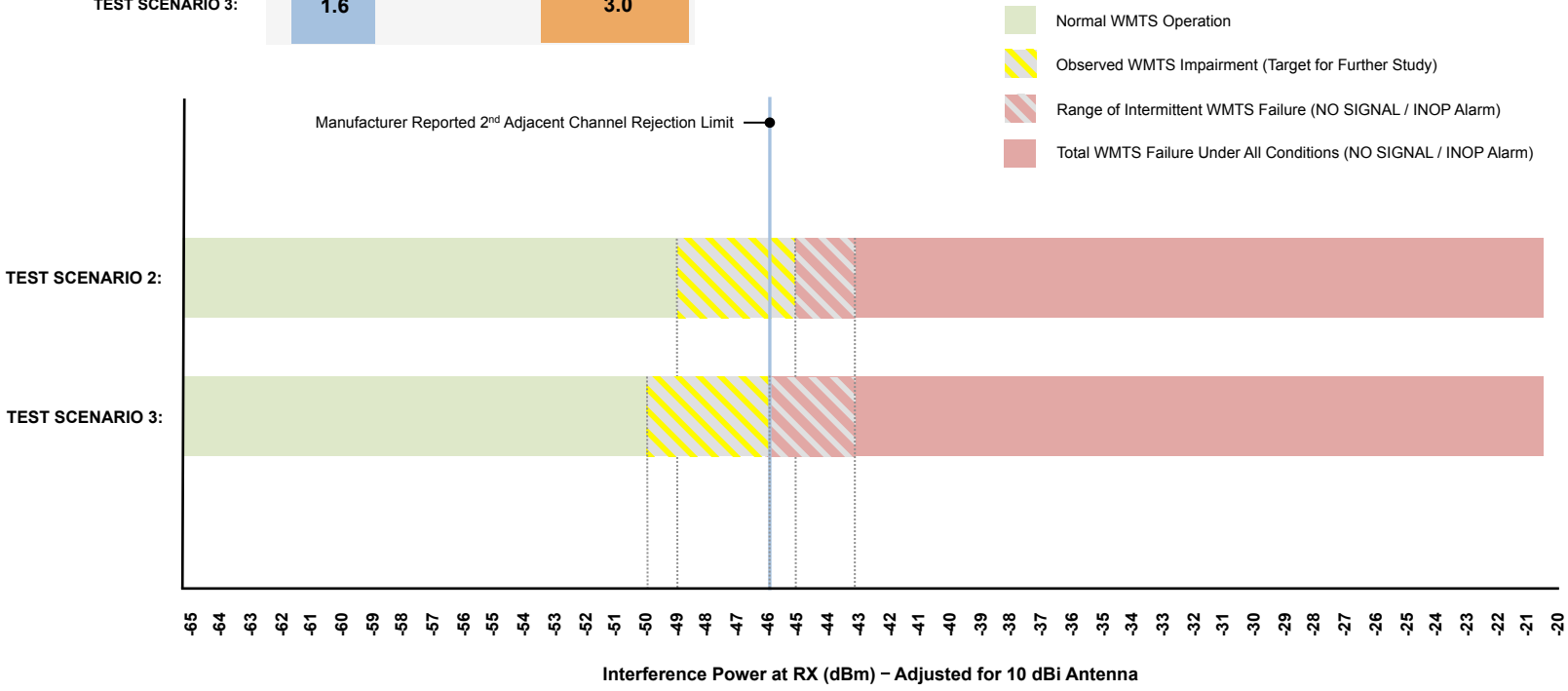
Conducted interference tests of the upper band were designed to indicate the incident power levels where WMTS operation was fully impaired. In Scenarios 2/3, 32 test runs indicated onset of WMTS failure at interference power levels from -46 dBm to -43 dBm.



Upper Band Test Conditions:

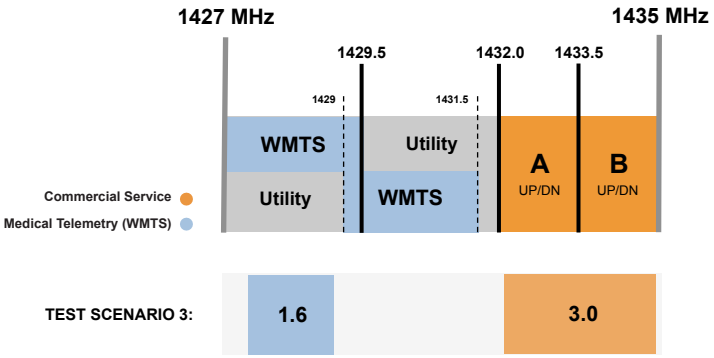
Interference Source: 1.5 MHz / 3.0 MHz 802.16 Emission
Duty Cycle: ~60%
Incident Power at RX: -75 to -30 dBm

WMTS Source: 1.6 MHz DECT Emission (Channel 4)
Duty Cycle: Variable, ECG + Sp02 from single human subject.
Incident Power at RX: -84 dBm (minimum)



LOS WMTS Failure Range for Low Power Device Interference

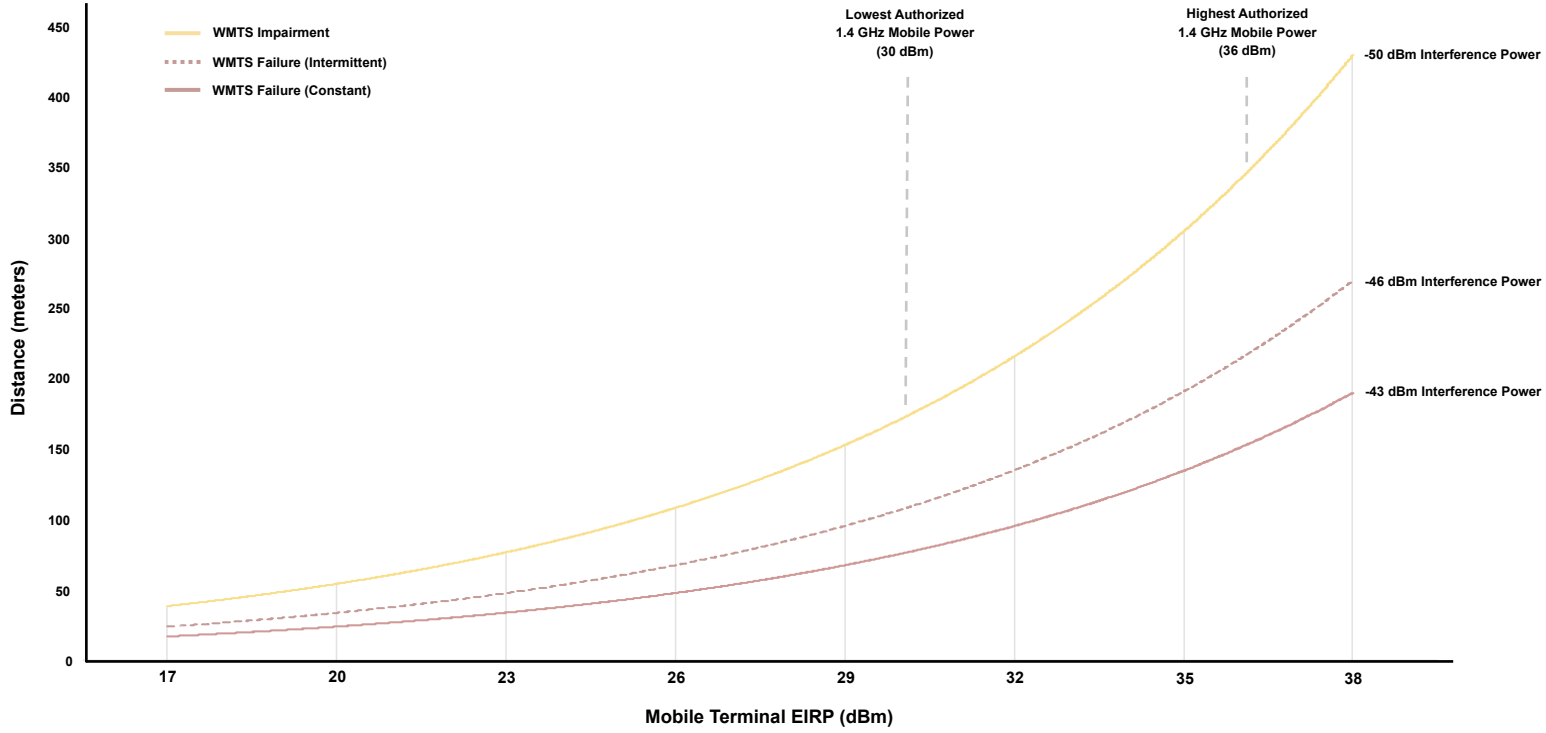
Test Scenario 3 revealed onset of intermittent WMTS failure at interference power levels of -46 dBm. This indicates large LOS interference zones for low power mobile terminals. Duplex operation of the commercial 1.4 GHz band presents significant risk to WMTS.



Upper Band (Scenario 3) Test Conditions:

Interference Source: 3.0 MHz 802.16 Emission
Duty Cycle: ~60%
Incident Power at RX: -75 to -30 dBm

WMTS Source: 1.6 MHz DECT Emission (Channel 4)
Duty Cycle: Variable, ECG + Sp02 from single human subject.
Incident Power at RX: -84 dBm (minimum)



VII: Conclusions of the Initial WMTS Interference Study

Conclusions of the Initial WMTS Interference Study

① WMTS Interference Problem is Confirmed

- WMTS receivers are significantly desensed by fully compliant fundamental emissions in adjacent 1.4 GHz commercial spectrum.
- Relatively low incident power levels (-46 dBm) can cause intermittent failure of WMTS patient telemetry links.
- Widespread deployment of WMTS networks makes probability of patient harm from monitoring disruption extremely high.

② WMTS Interference Problem is Caused by Insufficient Receiver Selectivity

- WMTS networks must operate with extremely low power (<10 mW) patient worn telemetry transmitters.
- Commonly deployed WMTS receivers use Surface Acoustic Wave (SAW) filters with very wide passbands (~64 MHz).
- SAW filters in WMTS receivers apply no attenuation to any part of the adjacent 1.4 GHz commercial allocation.

③ WMTS Interference Problem is Not the Result of Regulatory Non-Compliance

- All currently certified 1.4 GHz Smart Grid and WMTS transceivers are fully compliant with Parts 27 and 95.
- Part 95 rule compliance does not require demonstration of adjacent band rejection by WMTS receivers.
- Relevant standards for medical device interference immunity exempt the commercial 1.4 GHz band.